Quarterly Progress Report

Project No. DE-FC26-05NT42304

Lovelace Biomedical and Environmental Research Institute
Albuquerque, NM

Health Effects of Subchronic Inhalation of Simulated Downwind Coal Combustion Emissions

Quarter 6

May 1, 2006 – July 31, 2006

Project Director: _____ Date 8/9/06

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1. Executive Summary

This Report describes progress during the 6th quarter of project DE-FC26-05NT42304 "Health Effects of Subchronic Inhalation of Simulated Downwind Coal Combustion Emissions". The project was initiated on February 3, 2005. This report describes progress through July 2006.

The purpose of this project is to conduct a comprehensive laboratory-based evaluation of selected respiratory and cardiac health hazards of repeated, subchronic (up to 6 months) inhalation of simulated key components of "downwind" emissions of coal combustion. This project is being performed as an integral part of a joint government-industry program termed the "National Environmental Respiratory Center" (NERC), which is aimed at disentangling the roles of different physical-chemical air pollutants and their sources in the health effects associated statistically with air pollution. The characterization of the exposure atmosphere and the health assays will be identical to those employed in the NERC protocols used to evaluate other pollution source emissions.

The project has two phases, each encompassing multiple tasks. Guidelines for the composition of the exposure atmosphere were set by consensus of an expert workshop. The capability to generate the exposure atmosphere, and pilot studies of the comparative exposure composition using two coal types, will be accomplished in Phase 1. In Phase 2, the toxicological study will be conducted using one of the coal types tested in Phase 1. This project provides 50 % support for the work in Phase 1 and 20% support for the work in Phase 2.

Phase 1 is now completed. The Phase 1 report was submitted, progress and results to date were reviewed, and approval to proceed with Phase 2 was granted.

Recent effort was directed toward achieving greater burn-out of carbon in the particulate matter from PRB coal. That has now been achieved, largely by improving the control of coal feed rate.

- completion of Phase 1
- permission to proceed with Phase 2
- Achievement of satisfactory carbon burn-out.
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The subchronic inhalation exposures of animals for the health study are scheduled to begin in October 2006.

2. Results of Work During Reporting Period

a. Approach and Status

1) Approach

The general approach taken in this project has not changed from that described in the application. The project is divided into two phases. The approach to Phase 1, Task 2 involves conducting iterative generation trials with PRB coal in an attempt to meet the target ratios of particulate and non-particulate components at target total particle mass concentrations. These trials will serve to work out any technical problems that we may encounter in the generation system. Task 3 then repeats the iterative generation trials with CALS coal. The results from the two coals will then be compared to determine: a) whether or not it is equally practical to conduct the subchronic exposures with either coal, and b) comparative composition differences that might provide a basis for selecting the coal for the subchronic study. The results are summarized in a report, which comprises Phase 1, Task 4, and thus completes Phase 1. Phase 2 consists of the conduct of a subchronic inhalation exposure of animals and measurement of health effects.

2) Status

The last progress report described progress through completion of Phase 1, Tasks 2 and 3. We reviewed progress in detail during the May 16-17 annual meeting of the National Environmental Respiratory center (NERC), which the Project Officer attended and which thus constituted a site visit review. Since that report, we completed Phase 1, Task 4 by submitting the Phase 1 report on June 16, 2006. That report was to be the basis for a go-no go decision regarding whether to conduct the inhalation study and which coal type to use. On June 19, 2006, the Project Officer indicated approval to proceed with the inhalation study using PRB coal, which had also been the recommendation of the NERC advisory committee. Work since that time has been directed at "dialing in" the final exposure atmosphere using PRB coal. The initiation of the subchronic inhalation study is scheduled for October 2006, based primarily on working that study into the LRRI exposure schedule.

b. Activities and Progress

Key activities since the last report are summarized above. The principal technical activity has been to bring the exposure atmosphere closer to the target specifications, now that the PRB coal has been selected. The last progress report showed that we were near the target composition criteria with the PRB, pending the improvement of carbon burnout and decrease in the ash percentage of the total atmosphere. We have focused on improving the ash burnout, and have had success by taking several measures.

We added an electronic control on the coal feeder that delivers coal in a steady supply to the aerosol stream. This allowed us to slow the feed rate and gain improved control at lower feed rates. Several other factors, such as changing the proportion of combustion air versus

aerosol air, were evaluated. These proved to have no significant impact on carbon burnout. The single biggest factor was the decrease in coal feed rate and control. Table 1 shows the results of carbon (thermal/optical analysis) and particle mass analysis for four individual trials. In all cases the % carbon (particle carbon versus total particle mass) was less than the desired target of 10 %. This is also depicted in Figure 1 as an average % carbon for all of these trials. The first two trials were done with the combustion air at ~15:1 ratio to aerosol, and the second two trials were done at a lower ratio (~10:1). As indicated above, this did not significantly impact the burnout. In all cases the total concentration was higher relative to the final target. These concentrations were measured in the mixing chamber, not the final exposure chamber. Because the focus has been on evaluating burnout, the adjustment of concentration in the exposure chamber is not yet complete. This near final step is underway and is expected to be completed shortly.

Table 1. Particle Mass vs. Percent Carbon

Trial No.	Carbon	Total Particle Mass	% Carbon
1	25.41	1122.00	2.26
2	16.89	491.00	3.44
3	19.37	412.00	4.70
4	23.83	432.00	5.52

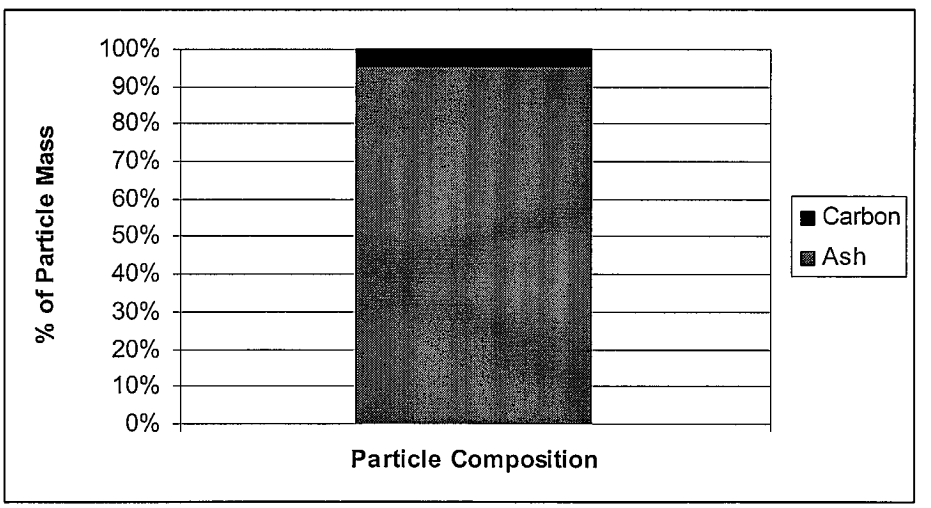

Figure 1. Percentage of Carbon vs. Ash in Particulate Phase of Drop-Tube Furnace Effluent. (The target carbon percentage of 10 % or less was achieved.)

Concurrent to the development of the final atmosphere, we have started on the development of study protocols and standard operating procedures. These protocols will be finalized and several system operators will be trained to operate this system.

Throughout training, the system will continue to be in operation to enable the system robustness to be evaluated.

c. Results and Discussion

To date, we have nearly 3 months of system operation experience. Although some system components have failed, we have not had any critical failures that could not be resolved by repair, procedure modification, or replacement.

d. Conclusions

We have achieved the required carbon burnout, and have only to dial in the final exposure concentrations and complete protocols and SOPs to be prepared for initiation of the subchronic inhalation exposure. Overall, the system appears to be sufficiently robust to ensure continuous operation throughout the health studies.

3. Milestones

Significant events are described above. Phase 1 is completed. The completion of Phase 1 was accomplished approximately 2 weeks later than originally scheduled.

The Project is now in Phase 2, Task 1, "Set up and test multi-level exposure system"

4. Cost and Schedule Status

a. Cost Status

DOE expenses as of 7/31/06:	$ 379,942.83
LRRI cost share as of 7/31/06:	$ 75,988.56
Other cost share as of 7/31/06:	$ 303,954.27
Total expenditures as of 7/31/06:	$ 759,885.66

b. Schedule Status

The project is on schedule in view of the October start date necessitated by allocation of personnel resources among LRRI exposure studies. The initiation of animal exposures will occur approximately 2 ½ months later than scheduled at the initiation of the project.

5. Significant Accomplishments

Significant accomplishments during the past quarter are described in more detail above. In summary, we accomplished:

- completion of Phase 1
- permission to proceed with Phase 2
- Achievement of satisfactory carbon burn-out.

6. Problems, Delays, and Corrective Actions

We have overcome past delays, and only the impact of the LRRI exposure calendar prevents us from beginning the animal exposure on the original schedule. There are no technical problems that are limiting progress at this time.

7. Technology Transfer Activities

There have been no technology transfer activities or issues to date. It is not anticipated that this project will generate any intellectual property or technical advances that will raise technology transfer issues. The product of this project is explicitly information on the health effects of exposure to modified coal emissions, and that information is to be communicated to the scientific community, public, and other stakeholders through peer-reviewed, open literature publications.